John Holdren pointed out that "clean-burning, non polluting, hydrogen-using bulldozers still could knock down trees or build housing developments on farmland." Now, could somebody tell me, where is the disdain here?

I declare I stopped reading *Nonsense on Stilts* after Chapter 6 because of a quote used by Pigliucci himself when discussing Lomborg's book. According to Thomas Henry Huxley, "many a beautiful theory was killed by an ugly fact." I cannot think of a more appropriate quote for Pigliucci's book.

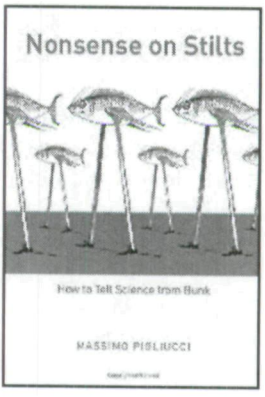
CONSTANTIN CRANGANU
Brooklyn College of the City University of New York
Dept. of Earth and Environmental Sciences
2900 Bedford Avenue, Brooklyn, NY 11210
cranganu@brooklyn.cuny.edu

Nonsense on Stilts: How To Tell Science from Bunk by Massimo Pigliucci. The University of Chicago Press, 2010. 336 pp. $20 (paperback). ISBN 9780226667867.

Nonsense on Stilts, by Massimo Pigliucci, takes its name from a quote by Jeremy Bentham, the English utilitarian philosopher. The book aims to provide the average person with the tools required to differentiate science from non-science—a classic problem in philosophy of science. Massimo Pigliucci is both a scientist and a philosopher as, according to his bio at platofootnote.org, he holds a doctorate and two Ph.D.s—in genetics, evolutionary biology, and philosophy. He is currently a professor at the City University of New York and "noted skeptic."

The writing style of *Nonsense on Stilts* is readable and accessible to those who don't have a philosophy or scientific background, and some sections are bound to be informative even if you do, as the scope of the book is huge. It contains information about basic philosophy of science to the representation of science in the media as well as discussions about controversial scientific topics in politics and the courtroom (global warming and intelligent design, respectively). It also contains a quick rundown on the history of the development of science as a break-away discipline from the grips of theology and philosophy (from the pre-Socratics to the founding of modern science). And he also manages to cover more current developments in philosophy of science with two chapters dedicated to the "science wars" and finally a chapter where he discusses the role of the expert.

He skillfully manages to cover this extensive ground while making the book an enjoyable, easy read. His apparently affable personality shines through



which is refreshing in comparison with many books on philosophy of science/science, and he slips in an appropriate level of personal information about his own history, opinions, and experiences. It is remarkable what he manages to cover in the book (which runs to 300 or so pages), and it is replete with many great quotes, examples, and backstories which make the ideas discussed come alive.

But perhaps because the scope is large we don't see the analysis put to work as it should be. Massimo Pigliucci obviously has a great love of science and what it can do to help us understand the world and universe we live in. I fully support the idea that drives the book: the need to provide people with the tools to make a judgment about scientific knowledge for themselves. He acknowledges that science is complex and that it is not easy for the average person to come to grips with how to make an assessment about what constitutes good science and what bad or even what to make of the information that science presents us with. His knowledge of what is currently accepted as "good science" is well-founded and thoughtful.

The troubles start when you begin to see he uses the same rhetoric he set out to dispel to promote his own skeptical agenda, which he wears on his sleeve. This is a shame, because if you take his basic message and apply it you will be able to do as he wishes—make an informed assessment of science, controversial or not, based on the notion that:

> What all scientific inquiry has in common, however, are the fundamental aspects of being an investigation of nature, based on the construction of empirically verifiable theories and hypotheses. These three elements, naturalism, theory, and empiricism, are what make science different from any other human activity. (p. 303)

He lets the reader down because he doesn't apply his own analysis to the all of the topics he is examining in the book.

For instance, even early in the book, before a definition of pseudoscience has been given, we are informed that "The disciplines in the middle land may one day be recognized as full members of the scientific enterprise, as is happening to areas of psychology that are turning into cognitive science; *or they may slide into pseudoscience, as happened in the past to astrology and parapsychology*" (p. 25, my italics). This is an early indication that once you get to the section on psi research it is going to be a teeth-grinding exercise if you are more familiar with the actual evidential status of parapsychology. And sure enough it is.

He has clearly already made up his mind about what areas of human enquiry are to be categorized as pseudoscientific. This goes against the grain of the book which is otherwise a rational, thoughtful exploration of science. It would have been much more helpful and, I think, led him to a different analysis of parapsychology had he first of all set out the benchmarks he would use to delineate a pseudoscientific enterprise (which he outlines on p. 42) and then applied them to an analysis of the best available contemporary evidence for the areas that are controversial such as parapsychology (the aspect of the book on which I've been asked to focus for this review).

When Massimo Pigliucci does come to reveal why parapsychology is pseudoscientific he admits that he can grant it only a short space in this book. He says so much has already been written in this area, which presumably is a reason not to give it much space. He refers the reader to the other books using a footnote; these are: *Flimflam!* by James Randi, *Skeptical Odysseys: Personal Accounts by the World's Leading Paranormal Inquires* by Paul Kurtz (Ed.), *Pseudoscience and the Paranormal* by Terence Hines, The *Skeptic's Guide to the Paranormal* by Lynne Kelly, among others, also noted skeptics. Need I go on?! It would be refreshing to see a skeptic reference other than their own, but alas we are let down here. As we are with the analysis.

The two examples selected for scrutiny in this section are the PEAR laboratory PK experiments and the J. B. Rhine Zener card experiments. Pigliucci acknowledges that "what the PEAR group did surely qualifies as science" (p. 78), but he criticizes them for using statistical significance to measure the results of a long-run experiment, as well as failing to maintain adequate baseline readings. The first is a problem which any scientific endeavor using statistical significance for large amounts of data will encounter (something he acknowledges does occur in other areas of science). But he ends with the point that when the measurement is small and indicative of something which "violates the laws of physics!" (p. 80), you would be better to dismiss the evidence. This contradicts something earlier in the book where he acknowledges "indeed, physicists themselves are beginning to question whether the so-called laws of the universe are truly universal or instead apply locally, in either time or space" (p. 53). In contemporary philosophy of science the idea that there are universal, unbreakable laws is certainly debated. If you are going to critique parapsychology for its use of statistics in these instances, you will need to apply the same analysis across the board to every other area of scientific endeavor.

On the second count, the lack of a baseline, he references a skeptic's account of the criticism but fails to mention that a member of the PEAR group of researchers, York Dobyns, had responded to this critique and that currently there is no unanimous agreement among scientists who have weighed in on the issue as to whether or not the problem invalidates the research (Broderick, 2007:33–38). The lack of discussion is alarming.

Massimo Pigliucci then goes on to introduce the work of J. B. Rhine. But here the little snippets of information that make the book interesting in many other sections are used to produce the notion that Rhine was motivated by crazy beliefs in things such as talking horses as well as a dated interest in Lamarckian theory. Whether consciously or not, Pigliucci is priming the reader to think that it is unlikely good science could come out of the lab of someone like this. It is also a strange selection. J. B. Rhine's research was first undertaken in the 1920s, so it is representative of research from nearly a century ago. The study of psi has progressed significantly since then and though Rhine was an important "founding father" of parapsychology, he is in no way representative of what is going on in contemporary parapsychology. For instance, the long runs of the same boring material are not carried out anymore. Pigliucci criticizes the research on the same account as the PEAR experiments: problems with randomness and statistical significance. But rather than take the point into a broader discussion about the use of statistics in science he instead infers Rhine's experimental methodology was flawed and open to fraud. Thus leaving the uninitiated reader in doubt as to the validity of psi research unfairly. (No wonder the myth perpetuates!)

He fails to mention that parapsychology as a scientific discipline has learned from these early experiments and continued to produce positive results at the same time as taking into consideration some of the methodological problems apparent in the early experiments. Look at the development of the ganzfeld and autoganzfeld experiments to see where these early Zener card experiments eventually led—to the point where even some skeptics acknowledge there is something going on (for example the Honorton/Hyman joint communiqué in Bem & Honorton, 1994:9). If more thinkers approaching the evidence from the skeptical perspective acknowledge there is something to explain, then we might see further theoretical development leading, eventually, to a satisfying explanation for all concerned.

It is on this area of scientific explanation that the book is noticeably silent. Psi does pose a challenge to science because the mechanisms are not able to be explained. This doesn't mean it is impossible nor that it will never be explained. The idea that theories compete to account for the same dataset is explored briefly (p. 74). But how to judge between the theories is only glanced at. There is the recommendation that one should employ Occam's Razor, but contemporary discussions in philosophy of science involve much more sophisticated analyses when confronted with competing explanations.

With regard to scientific explanation, philosophy of science has been in a state of debate since the demise of the covering law theory in the early 1970s. Although one wouldn't expect a detailed analysis of this complex area of philosophy in a book already covering so much ground, there should be some acknowledgement of how philosophers (and some scientists) are attempting to develop thought in this regard. (For example, the competing explanation

theories of Bas Van Fraassen, Philip Kitcher, and Wesley Salmon.) Some ideas put forward in the discussions that do take place in philosophy are that the "best" explanation is the most comprehensive explanation vs. the "best" explanation is the most useful explanation. These all impact on areas of science in which there are data but competing explanations, such as in parapsychology.

At one stage in the book Massimo Pigliucci himself admonishes skeptics for leaping to conclusions without first becoming acquainted with the facts (in the section on UFOs, p. 75). And yet he does the same thing in his brief discussion of parapsychology. It is possible for both sides to acknowledge the evidence and agree to disagree about the explanation and see what eventuates. It would be good to see a book like this, which already covers the territory so well in other areas, acknowledge that the problem is not the doing of the science, it is the explanation of the data which is at issue. And discussions about explanation can lead to discussion (rather than debates), which is expected and helpful when there is a scientific problem to solve.

There is one chapter in the book which is equally relevant to both groups: the representation of science in the media. Much of what Pigliucci has experienced as he takes his message to the mainstream press will be familiar to those who have also tried to get a fair hearing on controversial topics such as psi research. His experiences show how difficult it is for anyone making public comment about complex issues in science. It is in this chapter that you feel you get to know the author and can identify with some of the problems he faces.

I can recommend this book as an excellent source of readable information about science—its history and controversies. But not as a book which applies the analysis fairly to all areas of scientific enquiry. It also provides insight into the sophisticated rhetoric and views of a "noted skeptic" where topics such as parapsychology are covered. It left me feeling sad that so much work in psi research is still dismissed by those who should clearly be able to apply their own calls for intelligent, thoughtful analysis to bear on the subject.

So, if you do read this book, it is wise to heed the advice Massimo Pigliucci leaves us with: "Never, ever, forget to turn on your baloney detector" (p. 305).

HANNAH JENKINS
University of Tasmania
hjenkins@utas.edu.au

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